National Institute of Environmental Health Sciences

Parasitic and infectious disease responses to changing global nutrient cycles

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Abstract:

Parasitic and infectious diseases (PIDs) are a significant threat to human, livestock, and wildlife health and are changing dramatically in the face of human-induced environmental changes such as those in climate and land use. In this article we explore the little-studied but potentially important response of PIDs to another major environmental change, that in the global nutrient cycles. Humans have now altered the nitrogen (N) cycle to an astonishing degree, and those changes are causing a remarkable diversity of environmental and ecological responses. Since most PIDs are strongly regulated by ecological interactions, changes in nutrients are likely to affect their dynamics in a diversity of environments. We show that while direct tests of the links between nutrients and disease are rare, there is mounting evidence that higher nutrient levels frequently lead to an increased risk of disease. This trend occurs across multiple pathogen types, including helminths, insect-vectored diseases, myxozoa, and bacterial and fungal diseases. The mechanistic responses to increased nutrients are often complex and frequently involve indirect responses that are regulated by intermediate or vector hosts involved in disease transmission. We also show that rapid changes in the N cycle of tropical regions combined with the high diversity of human PIDs in these regions will markedly increase the potential for N to alter the dynamics of disease. Finally, we stress that progress on understanding the effects of nutrients on disease ecology requires a sustained effort to conduct manipulative experiments that can reveal underlying mechanisms on a species-specific basis.

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Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Air Pollution, Ecosystem Changes, Food/Water Quality, Food/Water Security

Air Pollution: Ozone

Food/Water Quality: Biotoxin/Algal Bloom, Other Water Quality Issue

Water Quality (other): Eutrophication; Acidification

Food/Water Security: Agricultural Productivity

Geographic Feature:

resource focuses on specific type of geography

Freshwater, Ocean/Coastal, Tropical

Geographic Location:

resource focuses on specific location

Global or Unspecified

Health Impact:

specification of health effect or disease related to climate change exposure

Infectious Disease, Morbidity/Mortality

Infectious Disease: Airborne Disease, Foodborne/Waterborne Disease, General Infectious Disease, Vectorborne Disease

Airborne Disease: Tuberculosis

Foodborne/Waterborne Disease: Cholera, Fascioliasis, Schistosomiasis, Vibrioses, Other Diarrheal Disease

Vectorborne Disease: Flea-borne Disease, Fly-borne Disease, General Vectorborne, Mosquito-borne Disease, Tick-borne Disease

Flea-borne Disease: Flea-borne Diseases, General, Plague

Fly-borne Disease: General Fly-borne Disease, Leishmaniasis, Onchocerciasis, Trypanosomiasis, Other Fly-borne Disease

Fly-borne Disease (other): Filariasis

Mosquito-borne Disease: Malaria, West Nile Virus, Other Mosquito-borne Disease

Mosquito-borne Disease (other): Cache Valley Fever

Tick-borne Disease: General Tick-borne Disease, Lyme Disease

Resource Type:

format or standard characteristic of resource

Review

Timescale:

time period studied

Time Scale Unspecified